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# MYTH AND ERROR IN THE RISE OF NATURAL HISTORY

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NATURAL history is the raw material from which all the other biological sciences are made. As long as false notions made up a considerable part of conceptions regarding plant and animal life, rapid progress in those sciences was impossible. A survey of the "rubbish" in the rise of natural history explains, in some measure, why this progress is comparatively recent.

It is astonishing how long a myth or superstition, once it gets the popular ear, can live and thrive on mere repetition and, like Vergil's bird of Rumor, attain larger proportions as it goes. Darwin points out that in science false observations are far more serious than false theories. False notions must be discarded altogether before the foundations of a true theory can be laid. False theories, on the other hand, lead directly to true theories if the data on which they are based are true.

We are accustomed to think of mythology as emanating chiefly from Greece and Rome—a consequence of our over indulgence in classical studies. As far as ancient natural history is concerned we get more truth and less fiction from Grecian sources than from any other nation or from any other of the twenty centuries following that of Aristotle.

He, of course, is rightly regarded the father of natural history. While there is evidence that some valuable scientific work had been done previous to the fourth century, B.C., especially in medicine, yet to Aristotle must be given the credit of instituting the right method in advancing knowledge of natural phenomena. Notwithstanding the fact that he may have had some good authorities for reference, and the resources of Alexander's kingdom at his disposal in writing a natural history, yet his "Historia Animalia" is a remarkable achievement.

In reviewing a translation of a fragment of his work we note the following: That he classified sponges as animals and that he possessed accurate notions of the essential features and relations of mammals. He recognized ruminants by their four stomachs, the parts of which he describes in detail. He is more accurate in his knowledge of the circulation of the blood than most observers down to the time of Harvey. He treats of mollusks, crabs, etc., so as to leave no doubt that he had closely observed and studied them. He declared that the nature of animals and vegetables are similar. He had worked out a pretty accurate knowledge of bees and grasshoppers. He had observed the development of the chick embryo from three days on. His discussion of reproduction in fish—ova and spermatozoa—and their relations accords with the teaching of modern biology.

Osborne says of him:

> He distinguished five hundred species of mammals, birds and fishes, besides exhibiting an extensive knowledge of polyps, sponges, cuttle-fish and other marine forms of life. He understood adaptation of structure to function, distinguished between homogeneous tissues made up of like parts, and heterogeneous organs made up of unlike parts; he perceived the principle of physiological division of labor, unity of plan or type in certain classes of animals, and the forces of hereditary transmission.

For the most part Aristotle steered clear of mythical notions about animals that must have been generally believed by his contemporaries. His errors are many, but very pardonable when we consider his is the first real attempt to write a natural history. He speaks, for instance,

> of flying reptiles; other reptiles move by four limbs.
> In all animals the brain is without blood.
> The mammalian heart has three cavities.
> The lion has one bone in the neck, but no vertebræ.
> There is a kind of ox which has a bone in its heart and there is also a bone in the heart of the horse.

He seemed to accept the general belief that the eyes of serpents and swallows, if pierced with a pointed instrument, would grow again.

> If sheep drink of certain waters they will produce black lambs. And in Antandria there are two rivers, one of which turns the sheep white and the other black, and the Scamander appears to make the sheep yellow.
>
> All insects survive being divided, so that wasps live after being cut asunder —only the head will not survive alone.
>
> Eels, many insects, and some other animals spring from putrid matter; bugs from moisture, and some insects from the dew upon the grass.

He credits the story that the salamander puts out fire by walking over it. He says:

> Honey falls from the air—no honey is produced before the rising of Pleiades.

He believed that the fertilization of the egg was often brought about from the breath of the male, for if the hen of the partridge stands in the way of the breath of the male she conceives.

He thought that certain fish produced ova under the influence of the stars, and that sheep and goats produce males or females according to the water they drink.

When the wind is high bees carry a stone with them for a balance.

The bones of animals depend upon one bone and are connected with each other like the "veins," and there is no such thing as a separate bone.

Besides Aristotle's no other work has come down to us from the Greeks that ranks as natural history.

The Roman empire likewise produced but one naturalist—Pliny. But Pliny does not rank with Aristotle. In the first place he attempted to encompass all knowledge and must therefore have depended upon others for most of his information. And, though hating the Greeks, he acknowledges Aristotle his chief authority. The best of his work is Aristotle's, but it is mingled with more matter from other and less reliable sources.

The treatment of the elephant well illustrates the difference between the two. Aristotle's would take rank with that of an author of modern biology. But Pliny says the elephant has religious respect for the stars and veneration for sun and moon and that they purify themselves in the new moon. He speaks of a dull, domesticated elephant conning over his lessons in the night time. If an elephant meets a man lost in the desert he is merciful and points out the way.

Pliny credits other wonderful tales, such as the following:

Ethiopia produces horses with wings. A wild beast is found there characterized by a remarkably heavy head, being bent always toward the earth. Were it not for this it would prove the destruction of the human race, for all who behold its eyes fall dead upon the spot.

There is the same power also in the serpent called the basilisk—it destroys all shrubs by contact and by its breath; it burns up all grass and breaks the stones. To this dreadful monster the effluvium of the weasel is fatal.

Pliny couldn't believe the following, however—by a Grecian author of note:

> A member of the family of one Anthus is chosen by lot and then taken to a certain lake in the district, where after suspending his clothes on an oak, he swims across the water and goes away into the desert, where he is changed into a wolf and associates with other wolves for a space of nine years. He returns to the same lake, swims across, resumes his original form, only with the addition of nine years to his former appearance—and takes his former clothes as well.

Pliny adds:

> It is really wonderful to what a length the credulity of the Greeks will go.

We are quoting this to prove that his own credulity had a boundary.

He believed that certain animals possess knowledge of medicinal remedies, and devotes a whole chapter to that subject—every statement of which is doubtless fabulous. The dragon, he says, relieves itself of nausea which affects it in the spring, with the juices of the lettuce. The elephant counteracts the poison of a devoured chameleon by means of the wild olive, and the stag, the effects of poisonous plants by eating artichokes. Wood-pigeons, partridges and blackbirds purge themselves once a year by eating bay leaves—ducks, geese and other aquatic birds by vervain—cranes with bulrush, etc. Canine madness is fatal to man during the thirty days heat of the star Sirius; but dogs will never become rabid if on the fortieth day after the birth of the pup the last bone of the tail is bitten off. He says nature has also bestowed upon animals the power to presage wind, rain and storm, each in its own peculiar way, and accepted as "Science" divination from birds as practised at Rome.

Pliny's is a ponderous work—thirty-seven volumes in "Natural History." He has been justly called a "compiler of anecdotes" rather than a naturalist. He performed the service, however, of keeping alive interest in natural objects, but perpetuated a mass of falsehoods which supplied delectable pickings for the blind centuries that followed. Even by some in the nineteenth century he has been spoken of as the "greatest naturalist of antiquity." He certainly wasn't that and it would appear in the light—or rather darkness—of succeeding ages, he not only performed no very valuable service to natural history other than that mentioned above, but rather added a lot of matter which would have to be discarded before real progress could be made.

Pliny turned the trend downward—the retrograde movement culminating in that period generally known as the Middle Ages. It is not necessary to go into the difficult task of explaining the existence of such a period.

The domination of the Christian Church by the clergy did anything but quicken interest in the study of nature or any other kind of science. It was an age that could debate with fervor the question as to how many angels were able to stand on the point of a needle but the prevailing asceticism and scholasticism brought about abhorrence for all earthly subjects. It was thought idle to give attention to the study of plants and animals, for the world was soon to come to an end anyway and the best preparation for the event was to give one's self up to pious meditation.

The theologians made the Bible the unfailing, infallible guide on all questions. To pry into the secrets of nature was regarded as impious, since the Creator revealed Himself all that He willed in the Bible itself. But the mention of animals and other natural as well as miraculous phenomena in the Old Testament led the theology of the period to produce a natural history peculiarly its own.

It is rather interesting to see what would happen in science under such auspices and against such a background.

The standard theological text-book of science was the "Physiologus." Under this title are embraced some fifty Christian allegories. As its imagery is almost wholly taken from the animal world, it is also known as the Bestiary.

There were current at the time many marvelous descriptions of animals—and descriptions of some marvelous animals—by such vague authors as "the naturalists" or "the naturalist" or under the vague title of "History of Animals," but the "Physiologus" came to be the one generally accepted and quoted by the clergy and most widely known among the people.

Andrew D. White, who has been the most persistent student of this period, says the "Physiologus" remained the principal source of thought on animated nature for a thousand years. A translation of this remarkable book may be found in the Harvard Library—a version by Phillip de Thanu (1121), an Anglo-Norman poet, whose work is edited by Thos. Wright (1841).

In his preface Wright claims that the "Physiologus" was "founded on the Natural History of Pliny with a mixture of medieval fables, many of which had been borrowed directly or indirectly from the Orientals."

The original Greek manuscript was composed probably at Alexandria sometime during the second and third centuries.

The theologians of the medieval period were not prepared to question any of the animal tales then current, no matter how unreasonable or phantastic they might be. Investigation, observation and experiment were entirely omitted. Whenever questions of any sort arose, whether in theology or natural history, the advantage lay with the one who could cite most authorities and marshal the material in a form that would be most convincing. It is said that a long and spirited discussion took place as to how many teeth are found in the horse, but none of the debaters thought of looking into the horse's mouth.

The theologians had but one use for zoological knowledge, anyway—to illuminate their texts. Contributing as it did to the various necessities of the pulpit and people, the "Physiologus" came to be of no very definite content—great liberties were taken not only with the outward form, but modifications and additions were made to suit the purpose of the one who used it. So it is hardly to be considered a literary work at all; nevertheless its symbols found their way into the rising literature and had a powerful influence on the fancy of artists employed upon church buildings and furniture. In fact the "Physiologus" is the key to the meaning of much medieval sculpture and many paintings found in European churches to-day.

As a book it had many versions in Latin, German, French and English and still exists in about a dozen languages East and West.

With such a wonderful history it is not a wonderful piece of literature. It embraces, as has been mentioned, fifty allegories, which were supplemented by descriptions of the miraculous power of precious stones.

The characteristics of animals, real or imagined, are mentioned only to adorn the moral that follows.

That of the *lion* is quite typical:

> What is in Greek *leun* has in French the name King. The lion in many ways rules over many beasts, therefore is the lion king, now you shall hear how—
>
> He has a frightful face, the neck great and hairy, he has the breast before square, hardy and pugnacious—his shape behind is slender, his tail of large fashion and he has flat legs constrained down to the feet—he has the feet large

and cloven, the claws long and curved—when he is angry or ill-disposed he devours animals without discrimination—as he does the ass which resists and brays, Now hear without doubt the signification of this.

The lion signifies the Son of Mary—He is the King of all people without any gainsay—He is powerful by Nature over every creature and fierce in appearance with fierce look. He will appear to the Jews when He shall judge them, because they made themselves guilty when they hanged Him on the cross—and therefore they have merited to have no king over them.

The square breast shows strength of the Deity—by the tail is indicated justice, which is placed over us—by the leg which he has flat he shows that God was constrained; and it was necessary that He give Himself for us—by the foot which is cloven, is demonstrance of God—who will clasp the world, will hold it in His fist; by the claws is meant vengeance upon the Jews: By the ass, we understand the Jews very rightly; the ass is foolish by nature as the Scripture says; he will turn from the way, if one does not drag him entirely to it.—Just such nature have the Jews who are as fools—they will never believe in God unless they do it by force; they will never be converted, etc.

The lion when he will hunt and will eat prey, with his tail in truth, as is proved, he makes a track on the earth and leaves an opening that it may be an entrance to the beasts which he desires—and such is his nature that there will never be any beast which will pass over his mark or go beyond it.

The tail by its nature shows Holy Scripture—and the tail is justice which is placed upon us; by the track we understand Paradise rightly, and the breach is the entry which is prepared for us, if we do good and avoid evil.

The lion when he is angry, he hangs himself by his feet—he will hang himself in the earth when he is enraged.

We understand Christ in the semblance of the lion, etc., etc. . . .

Again Scripture says the lion has this nature—when we hunt him with his tail in flying he erases his track on the ground that we may not know how to seek him—remember this is a great signification.

The lion in flying covers his track—the track of the lion means incarnation which God would take on earth to gain our souls—and thus truly he did covertly—he placed himself in degrees of which each order was, of prophets, of apostles, until he was carnal man and was mortal for us . . . and thus he vanquished the Devil. . . . The lion fears the white cock and he has such a nature that he sleeps with his eyes open—the white cock signifies men of holy life. . . .

The lioness when she brings forth a dead cub, holds her cub and the lion arrives. He goes about it and cries till it revives on the third day.

Having read the allegory of the lion one can judge pretty easily the correct interpretation of the others.

The devil has his counterpart in the dragon, crocodile, onocentaur, the salamander, the siren, the serpent, the hedge-hog, the monkey, the fox and the whale. Hell is the track made by the lion's tail, or it is the fox's hole, or the depths of the sea; Christ—the lion, the eagle, the goat, the phœnix.

Some very surprising statements are made about these animals:

The *serpent,* cunning, sly, and aware of evil . . . when it perceives people who want to enchant it, will press an ear against the earth, into the other press its tail firmly that it hear nothing of the enchantment—persons bitten by snakes will sometimes dry up and die by burning.

The *hedge-hog* after mounting the grapevine, throws to the ground the ripest of the clusters, then descends and rolls upon the grapes, sticking them to its prickles and thus carries food to its offspring.

The *fox* covers itself with red earth, and lies down as dead. The bird, which sees it, thinking it is dead, will come to peck at it—into the fox's mouth it will put its head and beak. The fox takes the bird with a jump and devours it.

The *wild ass,* on March 25th brays 12 times, also 12 times in the night. This is to indicate that day and night are of equal length.

The *monkey* carries its favorite offspring in front, those it hates, at its back.

The *whale* places the sand of the sea on its back, and remains tranquil. The sea-captain, spying this apparent island, disembarks and builds a fire thereon. The whale feels the fire and plunges with ship and people into the sea. The whale has such a nature that when he wants to eat he begins to gape . . . and sends forth a smell so sweet and so good that the little fish, who like the smell, will enter into its mouth.

The *eagle* carries its young toward the sun and only the fledglings that gaze straight at the sunlight are acknowledged by the eagle as kin. . . . Physiologus says further, of the eagle, when it becomes old and feels its wings heavy, and when its sight fails, then it mounts high in the air and burns itself in the intense heat—then it goes to the east, sees a clear fountain wherein it dips three times and becomes young again.

The *phoenix* is a bird which is very elegant and handsome—it is the only bird of its kind in the world, and its color is all purple—it lives 500 years or more. In old age it burns itself by the sun's rays sitting above a heap of spice twigs . . . and is reduced to powder and on the third day comes to life.

*Caladrius* is the name of a bird, all white. It can distinguish in a man the infirmity he has—truly if he must die it will not deign to look at him, but if it will look at him, know of a truth that by its look it takes all the man's ill, draws all the disease to itself and the man recovers.

The popular natural history up to the seventeenth century was of similar character.

It would appear that the "Physiologus" and like productions shaped the early drama. We refer to the miracle plays of the Church in which the reader will remember that the Devil and other leading characters were shown by representations of animals.

Shakespeare's times were characterized by gross misconceptions of animal life—the ideas inherited from the Middle Ages and sometimes even improved upon. His plays are full of references of this kind, but that does not mean, of course, that he himself believed them; but if he sought knowledge from what had been written he must have gotten very many erroneous notions of animal life about him. Holland's Pliny was read by some and probably there existed other works on more scientific principles, but they were in Latin and published abroad.

There can be little doubt that Bartholomew's "On the Properties of Things," written about the middle of the thirteenth century, was the standard authority of the period. Bartholomew was an English Franciscan monk, who began with the intent of explaining the allusions in Scripture to natural objects, but expanded his work to a survey of all nature. It was translated into the principal languages of Europe and was widely read. For three hundred years it maintained its position—even after the invention of printing there were editions in several languags besides ten editions in Latin. As usual his descriptions were cast in a theological mould. Fabulous creatures of Scripture—the unicorn, dragon and leviathan—are described in detail.

Of the *Unicorn* he says:

> It is a right cruel beast and hath that name for he hath in the middle of the forehead a horn 4 ft. long and that horn is so sharp that he throweth down all that he rageth on. . And this beast fighteth oft with the elephant. And the unicorn is so strong that he is not taken with the might of hunters, but a maid is set there, and the unicorn cometh and layeth his head on her lap, and leaveth all his fierceness and sleepeth.
>
> There be many kinds of unicorns—Monoceron is a wild beast shaped like to the horse in body and to the hart in head, and in the feet to the elephant, and in the tail to the horse.

Bartholomew says:

> If a crocodile findeth a man by the water's brim he slayeth him if he may—and then weepeth over him.
>
> When father and mother crows wax old and feeble, then the young crows underset them and rear them up with their wings . . . and bring their members that be diseased into state again.
>
> Dolphins follow man's voice and come together in flocks to the sound of symphony. They leap over ships, etc.

In Bartholomew the descriptions of animals are not supplemented by the minute allegory of the Middle Ages, still animals exist only to teach moral lessons. Some are made, he declares, as lions and tigers, so that man should realize his own infirmities; flies and lice to torment him; noxious animals of all kinds were created to punish him for his sins.

Sir John Mandeville was another contributor to zoological knowledge. His work is entitled "Voiage and Travaile, which treateth of the way to Jerusalem and of marvyles of Inde with other islands and countryes." This is a translation from manuscripts of about the middle of the fourteenth century.

It is in the quaint English of three hundred years ago, and seems to have been very popular. Toward the close of that century more manuscripts may be found of Mandeville's book than of any other literary production, except the Bible.

He is very careful to assure his readers that he is telling the truth. In one place he devotes nearly a half page in coating his story with pious assertions. That his readers required some means of assurance is evident, when one reads of his "folk in Ethiope, that have but one leg and they run so fast that it is a marveyle, and the foot is so large that it shadoweth all the body against the sun when they wish to lie and rest."

He avers that there are rats in China as large as hounds. In another isle, fishes of a certain kind come once a year and cast themselves upon the bank in such great multitudes that nothing but fish can be seen. And there they remain three days and men gather as many as they like. But after the third day the remaining fish go back into the sea. After them come a multitude of another kind, and after them still another, till all the diverse manner of fishes have been there. Mandeville adds: "It is the most marveylle that ever I saughe."

He speaks of an entire island eight hundred miles long, literally filled with serpents, dragons and crocodiles. The island was supplied with an abundance of water, a great lake formed from the tears of Adam and Eve, who wept on the mountain above for one hundred years, after they were driven out of Paradise.

In the same country and others about are wild geese that have two heads. In India he found hens without feathers, but they had white wool like that of sheep.

In "Caldilhe" (wherever that might be) he found a "fruyt" growing on trees as though they were gourds. When they are ripe men cut them in two and find within a little beast, in flesh, bone and blood like a little lamb, but without wool.

Mandeville mentions at this point that he told the natives about the "goose barnacles" of his own country, which also were supposed to grow on trees, and to fall off into the water and swim about like geese.

In another place he found a people who live entirely on the smell of wild apples.

His travels contain a full account of many of the animal stories of the "Physiologus," including the fierce ants that hoard up gold, which is gotten from them by sending across the stream to the meadows where they dwell, mares loaded with empty baskets. These are filled by the ants and the mares return to their offspring.

In Mandeville and Bartholomew allegory is either wanting or used sparingly. But the purpose of both was to contribute to the edification of the saints.

There is some question whether Mandeville spent thirty-four years in the East, as he claimed, or traveled there at all. His tales, however, were popular reading during the period of discovery in the latter part of the fifteenth century, when the imagination was quickened by the return of explorers from new countries across the seas.

Besides Bartholomew and Mandeville there were several other authors whose descriptions of the wonders of nature found favor, among them Topsell's "History of Four-Footed Beasts and Serpents" (1658), Harrisons's "Description of Britain" (1577) and Lupton's "A 1,000 Notable Things" (1595). These were, in substance, similar to those from which we have quoted, and contain many of the same accounts, sometimes in new form.

Rather earlier than the publication of these came the re-discovery of Aristotle's history, and the effect was that naturalists again sought to learn by observation of real animals.

We see this influence in the work of Edward Wolton, an English physician, who published in 1552 his "De Differentibus Animalium." It was based on Aristotle, with additional matter.

In the year previous appeared Gesner's first of five volumes, a "History of Animals," of over three thousand pages and nearly a thousand excellent figures. His great service was the introduction of good illustrations. In his volumes are retained a few pictures of the sea-serpent and mermaids, but Gesner ranks as the most brilliant zoologist between Aristotle and John Ray.

It would appear that Ray was the Moses that led the theologians out of the wilderness, in publishing toward the close of the seventeenth century his "Wisdom of God Manifested in Works of Creation," which passed through twenty editions. Ray argued the adaptation of animals not only to man's uses, but to their own lives and surroundings.

This conception of "creative design" while it can not be regarded quite the modern scientific attitude, which would make every tub stand on its own bottom, did bring about some really good work. The science of the period was in full accord with the theological notion that animals and plants had for their main purpose, the "profit, instruction, enjoyment, and amusement of man."

Ray's work probably inspired Paley's "Natural Theology" of the same century, and led to the Bridgewater Treatises of the middle of the nineteenth. The latter was the fruit of a provision in the will of the Earl of Bridgewater, by the terms of which the President of the Royal Society selected eight persons, each of whom received a £1,000 for writing and publishing a treatise "on the power, wisdom and goodness of God, as manifested in the Creation."

The leading essays were Chalmer's "Adaptation of External Nature to the Moral and Intellectual Condition of Man," Bell's "The Hand as Evincing Design," Roget's "Animal and Vegetable Physiology with Reference to Natural Theology," Kirby's "Habits and Instincts of Animals with reference to Natural Theology."

Only the last bears directly on natural history. If the others are as good as Kirby's, the Bridgewater Treatises were a very great advance over anything that had come previously from the church.

Kirby's is almost entirely free from fable and contains much real zoological matter. Such scientific investigators as Lamarck and Owen are frequently quoted and the attempt to give a true account of animal life seems to be adhered to.

But the author never loses sight of his main purpose and he is very careful to keep strictly to the orthodox account of creation. Scripture content forces him to retain the dragon, but he gives him a zoological classification and would fix his native abode in subterranean waters.